Abstract Submitted
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Eulerian models for particle trajectory crossing in turbulent flows over a large range of Stokes numbers[1] RODNEY O. FOX, Iowa State University and EM2C/Ecole Centrale Paris, AYMERIC VIE, FREDERIQUE LAURENT, Laboratoire EM2C - UPR CNRS 288, Ecole Centrale Paris, CHRISTOPHE CHALONS, Laboratoire Jacques-Louis Lions, Universite Pierre et Marie Curie - Paris 6, MARC MASSOT, Laboratoire EM2C - UPR CNRS 288, Ecole Centrale Paris — Numerous applications involve a disperse phase carried by a gaseous flow. To simulate such flows, one can resort to a number density function (NDF) governed a kinetic equation. Traditionally, Lagrangian Monte-Carlo methods are used to solve for the NDF, but are expensive as the number of numerical particles needed must be large to control statistical errors. Moreover, such methods are not well adapted to high-performance computing because of the intrinsic inhomogeneity of the NDF. To overcome these issues, Eulerian methods can be used to solve for the moments of the NDF resulting in an unclosed Eulerian system of hyperbolic conservation laws. To obtain closure, in this work a multivariate bi-Gaussian quadrature is used, which can account for particle trajectory crossing (PTC) over a large range of Stokes numbers. This closure uses up to four quadrature points in 2-D velocity phase space to capture large-scale PTC, and an anisotropic Gaussian distribution around each quadrature point to model small-scale PTC. Simulations of 2-D particle-laden isotropic turbulence at different Stokes numbers are employed to validate the Eulerian models against results from the Lagrangian approach. Good agreement is found for the number density fields over the entire range of Stokes numbers tested.

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